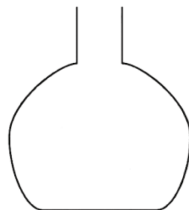Chapter 16 Rates of change: **Assignment**

Name _____

1 Water is poured at a constant rate into the flask shown. Sketch a graph showing how the depth of water changes with respect to time.

2 Assuming a constant speed, find the speed of a car that travels a distance of 140 km in 2 hours.

3 A hiker covers a distance of 23 km over a period of 4 hours. Assuming she walks at a constant speed, calculate her average speed over the 4 hours.

4 A shearer shears 120 sheep in 9 hours and is paid \$300.

    a Find the rate at which he shears sheep per hour.

    b Find how much he earns per sheep.

    c Find how much he earns per hour.

5 A cyclist spends 2 hours cycling from Swifts Creek to Tambo Crossing. The ride can be described in three stages:

Stage 1 He rides at a constant speed of 20 km/h for 45 minutes.

Stage 2 He rides at a constant speed of 15 km/h for 45 minutes.

Stage 3 He rides at a constant speed of 25 km/h for 30 minutes.

Draw a distance-time graph that illustrates this motion.

6 Find the average rate of change of the function $f(x) = 2x^2 - x$ as x changes from 3 to 5.

7 Find the average rate of change of the function depicted in the graph below for the interval $[2, 5]$.
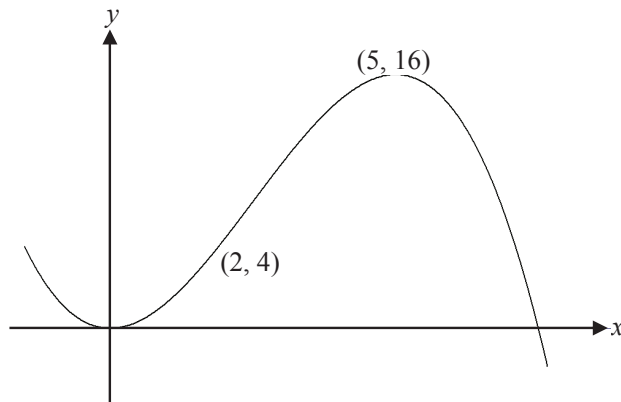
8 A candle burns with a steady flame and gradually diminishes in height. The height, h cm, of the candle after burning for t minutes is given by the rule $h = 18 - \dfrac{1}{4\pi}t$.

Find the average rate of change of the height of the candle in the first 3 minutes after it has been lit, correct to two decimal places.

9 By considering the chord joining the points where $x = 1$ and $x = 1.01$, estimate the gradient of the curve $y = 2x^3 + x$ at $x = 1$.

10 Let $s(t) = 5t^2 - 3t$ be the displacement function of a particle moving in a straight line, where t is in seconds and s is in metres.

  a Find the average velocity for the time interval $[0, 1]$.

  b Find the average velocity for the time interval $[0.9, 1]$.

  c Find the average velocity for the time interval $[0.99, 1]$.

  d Estimate the instantaneous velocity for $t = 1$.

11 For $y = 2\sin(x)$, find the average rate at which y changes with respect to x over the interval $\left[0, \dfrac{\pi}{4}\right]$.

12 Consider $y = 3^x$.

    a Find the average rate at which y changes with respect to x over each of the following intervals:

        i $[0, 1]$

        ii $[0, 0.5]$

        iii $[0, 0.1]$

        iv $[0, 0.01]$

    b Estimate the instantaneous rate of change of y with respect to x when $x = 0$.